

Space Weather Technical Forecast

Issued on Tuesday, 09 August 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Further Minor Geomagnetic Storms Likely through midweek. Active fluence Likely this week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with only B-class flares. Some minor spots have waxed and waned, and now there are 5 sunspots on the visible disk, all of which are simple. The main activity on the disc in the past 2 days has been the movement and potential disappearance of up to four filaments, though coronagraph imagery suggests that no filaments have lifted off in the direction of Earth.

Solar Wind / Geomagnetic Activity: Earth is currently under the influence of the fast wind from a positive polarity coronal hole, the most likely culprit is considered to be CH09. The solar wind, as measured by DSCOVR and ACE at L1, was elevated, generally between 530-600 km/s. The solar wind density was highest early in the period, with a peak near 19ppcc and waned through throughout. The IMF was Moderate initially, with a peak of 12nT, then became weak from around 0900 UTC. The north-south component meanwhile fluctuated between +11/-10 but gradually became weak also. The Phi angle was positive throughout. The net result of the above solar wind measures was a period of heightened geomagnetic activity initially (local K7 at Lerwick in the north), with overall G1/minor storm periods, before easing to Unsettled to Active by 0900 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES16, was at Background levels. The high energy electron flux (greater than 2 MeV) started at Normal Background levels before rising to generally above the 1000pfu level after 1500 UTC. Electron fluence was well below the Active (1e8 integrated pfu) threshold but has been on a rising trend. 4.54e7 integrated pfu was observed at 09/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low or very low solar activity is forecast, with a decreasing Slight Chance of an isolated M-class flare.

Solar Wind / Geomagnetic Activity: No CMEs feature in the current forecast. Solar winds are forecast to be elevated - perhaps peaking at strong - due to a succession of high speed streams: currently CH09/+, followed by CH10/+ and perhaps CH12/+ in turn. CH12 has only recently appeared and may not manifest at Earth, and in any case transition between all of these features may be indistinct for their all being of the same polarity. Transition between CH09 and CH10 has either already occurred or will happen early Day 1 (09 Aug).

Geomagnetic activity is now thought Likely to carry a more prolonged risk of G1 through midweek as a result of the succession of coronal holes. Solar winds may remain slightly elevated later this working week, however the threat of further G1 intervals should recede as the features mature, and Unsettled activity is perhaps more likely by this time.

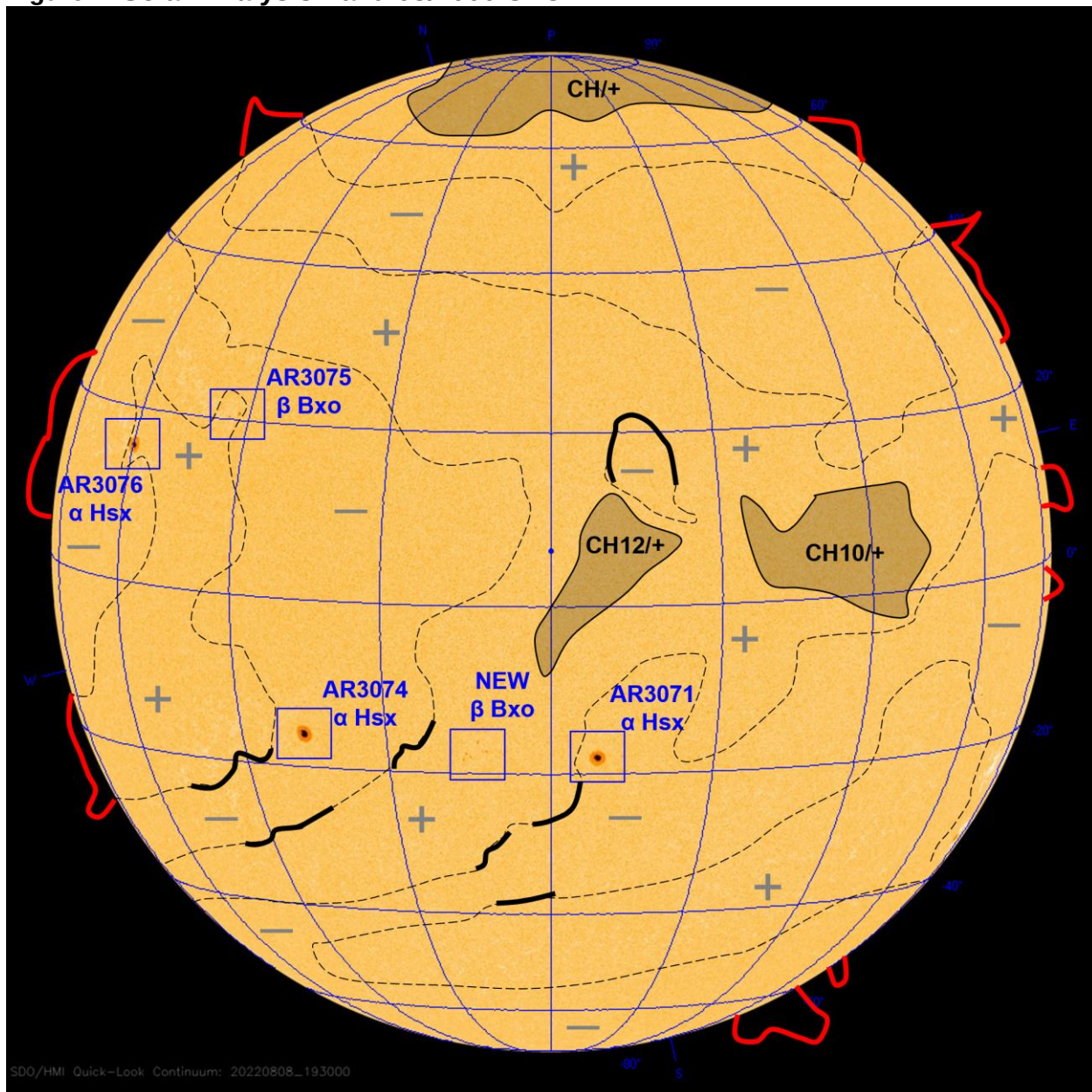
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

expected to remain at Background levels.

The high energy electron flux (greater than 2 MeV) is likely to continue increasing through the period, with diurnal maxima likely above the 1000pfu threshold. The ongoing protracted G1 risk may bring some brief spells of background or moderate electron flux levels, but as we exit any coronal hole influences by the end of the week, the risk of period of elevated flux will likely rise.

The associated fluence is expected to rise in response to prolonged periods of active flux, but may be subdued if we have further G1 periods. As indicated by REFM, there is a rising trend of the Active threshold being breached (1e8 integrated pfu) if not later on day 1 (09 Aug), then likely day 2 (10 Aug) onward.

Figure 1. Solar Analysis Valid 08/2000 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the current forecast, all previous filament lift-offs have been modelled as not being earth directed.

Solar winds are forecast to be elevated to strong due to a succession of high speed streams. CH09/+ then CH10/+ and possibly followed by CH12. This final coronal hole appears to have developed close to the central meridian. CH12 combined with CH10 may now give a more protracted spell at risk of G1, depending on whether there is an intervening lull and CIR or if the features form one continuous longer-lasting fast wind. There is also the question mark of whether these changes have occurred too late to manifest at Earth, as any fast wind emanating from CH12 will have a transit time to 1AU, and there is as yet no sign at STEREO A, two days upwind.

The most notable coronal hole feature of the forecast remains the large coronal hole CH10/+. This is a persistent feature, but larger, darker and more distinct on this rotation. Once the HSS from this feature connects with Earth and the anticipated fast wind arrival, based upon calculation from the leading edge of this feature, would suggest arrival Tues 09 Aug, however 27-day persistence indicates a slight enhancement during Day 1. Enlil also has one broad arrival, providing additional confidence for reduced time between CH09 and CH10 fast winds, with solar winds likely being maintained around 550-600 km/s.

Geomagnetic activity is now thought likely to carry a more prolonged risk of G1 through midweek as a result of the succession of CH09, CH10 and now CH12. Solar winds may remain slightly elevated later this working week, however the threat of further G1 should recede as the features mature, and Unsettled activity is perhaps more likely by this time.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	Yes	60	30	10	1
Strong	G3	No	10	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

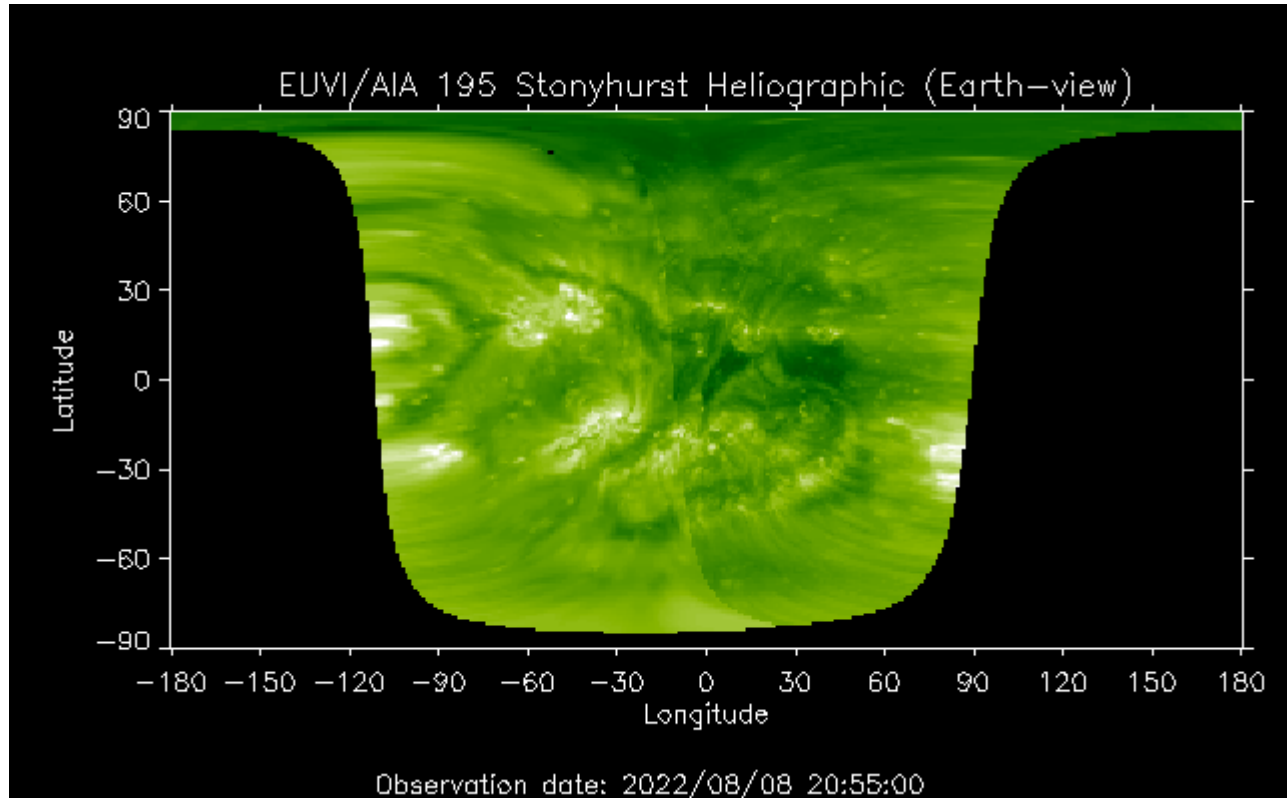
Radio Blackouts - X-Ray Flares:

There are now five sunspot regions on the solar disc, all are generally small and simple with a diminishing risk of M-class and C-class flares.

There are hints on STEREO A EUVI 195 imagery of a bright flux region waiting in the wings narrowly over the southeastern limb, however any contribution to flare risk will be assessed as and when this region appears for analysis.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: EUVI/AIA Stonyhurst Heliographic 195 imagery showing bright region just on or around the west limb (-90 degrees)



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	1	1	1	1
Very Active	$\geq \text{S3}^*$	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)

High Energy Electrons Event ($\geq 2 \text{ MeV}$):

The high energy electron flux (greater than 2 MeV) is likely to continue increasing through the period, with diurnal maxima likely above the 1000pfu threshold. The ongoing protracted G1 risk may bring some brief spells of background or moderate electron flux levels, but as we exit any coronal hole influences by the end of the week, the risk of period of elevated flux will likely rise.

The associated fluence is expected to rise in response to prolonged periods of active flux, but may be subdued if we have further G1 periods. As indicated by REFM, there is a rising trend of the Active threshold being breached (1×10^8 integrated pfu) if not later on day 1 (09 Aug), then likely day 2 (10 Aug) onward.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	50	60	70	70
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	5	5	5

Figure 3: REFM fluence forecast indicating likely rise in fluence values above the 1×10^8 pfu threshold by mid-week.

